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## ABSTRACT

The author presents a general discourse on the nature of performance-based education, in particular, performance-based teacher education, and presents considerations in the education of teachers of science. Pressures originating from the Pennsylvania State Department of Education are examined, as well as the University of Pittsburgh position toward performance based teacher education, approaches to implementation perceived from the school system viewpoint, outcomes as seen by the community, and benefits existing for children. It is suggested that to obtain a more realistic approach to PBTE, one must consider the background, cognitions, characteristics of persons, the persons themselves, and levels of role definition before identifying or specifying statements of competency. Discussion is presented on roles and the generation of competencies within a role theory framework applying to the specific discipline of science. In a final section, the author attempts to integrate the notions of roles and competencies within the assumptions of a process directed toward the individualization of teacher education in favorable support systems using guidelines and standards proposed by the American Association for the Advancement of Science. (MJB)

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TEACHER ROLES, MODELS, AND COMPETENCIES

IN PERSPECTIVE

FOR

SCIENCE EDUCATION

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# I. A PERSPECTIVE ON TEACHER ROLES, MODELS, AND COMPETENCIES

## A. Introduction

Teaching is the process by which one person helps others achieve knowledge, skills, and attitudes. At least two persons are always involved in teaching, the teacher and the learner. A good teacher provides guidance for the learner. This guidance encourages the learner to do things that result in desired learnings such as the ability to read and write. Learning is an activity of the learner. Teaching creates conditions that will encourage and stimulate learning.(1).

Notions of this type are at present simplistic and inadequate in developing full awareness of the ramifications inherent in the training and development of the professional teacher. Being involved in education means not only teaching to a learner but also being aware of and interacting with other people and components of the learning environment and system.

School administrators, community members, students, parents, and teachers represent human dimensions that either seek or are sought to participate in the interactive democratic process of building and maintaining local educative systems. Input for teacher training still emanates from teacher training institutes but has been expanded to field settings which include early pre-service experiences as well as inservice education. Focus within the training process has moved to competencies on the part of students, teachers, and paraprofessionals. In the practice of dealing with content and process or behavioral skills in the curriculum, new learning resources and technology has been called for as well as knowledge of change mechanisms and physical plant utilization. Likewise, to support the local educative system much more attention paid to legislation and financing of programs.

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With these factors in mind the teaching - learning process goes beyond the isolated act of teaching to include a series of inter-related acts embedded in a complex matrix of behavior or competencies in an accommodative learning environment. To deal more effectively with the child in an accommodative learning environment now demands an accommodative process of teacher preparation.

The ideas presented in this paper, in the author's judgment, are neither profound nor novel. They represent nascent notions of a nebulous gestalt regarding the roles, models, and competencies of individuals in a learning environment. No references or footnotes are needed to attest the fact that there is a deep awareness and feeling of need for educators to develop teacher competencies. State departments of education as well as teacher training institutions have begun to identify and specify competency lists. The Bureau of Planning in the Office of Higher Education of the Pennsylvania Department of Education has been engaged in program perusal in an effort to identify duplication of efforts in the commonwealth's higher education institutions. With the inundation of teachers on the job market I project that many federal, state, and local agencies will bring pressure to bear on teacher training institutions to avoid such a duplication of effort. The "prizes" awarded by funding agencies will go to those individuals and institutions who have developed programs and modules for the development of teacher competencies. I greatly fear that two limiting concepts are being nurtured in the great race of modular development for performance-based objectives. The first is... learning comes in small packages. The second is that...a competency based program is equated only with progression through learning modules.

There is merely any concern for the social system in the educational environment where teachers and children develop. What is needed is a perspective...a frame-work...a gestalt...that accounts for the role of the school and how it, as a social system, supports the development of roles, models, competencies, and behaviors of the teacher and learner.

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Concern and development of a perspective of teacher roles, models, and competencies requires careful analysis of alternative sources of input and resources. I raise the following questions, to state a few, in the process of developing these resources and the utilization of alternate sources of input:

(1) What press comes from the Pennsylvania State Department of Education; (2) What directions are visualized from the university position; (3) What approaches to implementation are seen from the school standpoint; (4) What are the outcomes as seen by the community; (5) What benefits exist for children; (6) What direction and press exists from NSTA or AETS; (7) Are aspects of the AAAS - Guidelines and Standards appropriate in the development of a perspective; and (8) Is there a taxonomy of science teaching competencies?

Once the perspective has been formulated it provides a basis for the analysis and synthesis of issues and practices employed in programs of individualization, accountability, performance contracting, and especially teacher education.

## II. SELECTED VIEWPOINTS

### A. Press from the Pennsylvania State Department of Education

We are living in an age of "financial accountability." The scrutinizing eye of the budget watchdog observes planning, design, and implementation practices at all levels of operation in schools of education. Strategies are being developed to assess supply and demand links and patterns in teacher education. We have achieved the "critical mass" of teachers on the available job market to find that the supply now exceeds the demand (2). Pressures from people within and outside the process of teacher education are asking... "now what?" The Pennsylvania Department of Education in response to public concern was forced to look at its sanctioning process and approbations. Secretary of Education, John C. Pittenger, in a letter to Presidents of the higher education institutions in Pennsylvania wrote:



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"Because of obvious financial limitations, we must begin to view all of higher education--whether teacher education or the liberal arts -- in terms of overall state needs and not just individual institutional aspirations. This is the only way that we can achieve the wisest distribution of the state's financial resources available to higher education. I have concluded that the best way to accomplish these goals is to differentiate between those programs which must be maintained or developed to serve the overall needs of the Commonwealth and those that would inflate the existing over-supply of graduates in particular fields. At the same time we must be cognizant of student interest and demand."

Enclosures with the letter state:

"Because of the present numbers of teachers being produced by Pennsylvania institutions, both public and private, and general supply and demand estimates, no further expansion of teacher education programs at undergraduate or graduate levels will be approved without adequate justification in terms of regional or Commonwealth need."

While some might say that this focus is limiting, the fact is that it is a role response by state officials coordinating and promoting renewed efforts in teacher education. Statements of this type delimit operating parameters for goal establishment by Pennsylvania educators, flexibility, improvement of the quality of teaching, participation throughout the educational system, improvement of administration and management, access to equal educational opportunity, and imagination in spending the limited education dollar productively.

There is no doubt that the University of Pittsburgh is inextricably bound with the Commonwealth of Pennsylvania in its education of the state citizenry. As the University fails in achieving the aforementioned goals the budget watchdog will surely choose to "reorder priorities" and "strike boldly in new direction" rather than fund continuing failure (3).

With the notions of financial support, accountability, certification, and program approval operating as specific environmental factors, the new breed of involved inter-institutional (school-community-university) educator will be different. A University department that does not respond to this environmental press will not survive. The support system has been delimited and flexibility to respond, change, and develop will determine survival.

In April, May, and June of 1973, educators from Pennsylvania's 33 higher education institutions met in Lock Haven, Pennsylvania to define leadership teams and develop a reduced list of competencies. This list, which was to come from over 10,000 statements of competency submitted by each institution, was to serve as a guide for program development in schools of education. This list or guide to program development would eventually lead to improved minimum standards and certification priorities for the profession. It became evident to the author that there was no clear agreement as to what should comprise the list. Arguments pro and con to competency based teacher education were given that mirrored sentiments already expressed by proponents and critics in the literature. After much argumentation the participants, (group leaders and co-leaders) united under the mandate of time press to define parameters for the final culling of the generic from specialized competency statements. In June of 1973 an "action" workshop for over 350 participants was initiated with addresses by Jerome Ziegler, Pennsylvania Commissioner for higher education, and Karl Massanari, Director of the American Association of Colleges for Teacher Education's Performance-Based Teacher Education Project. Groups of 10 to 15 members were then established and charged with the responsibility of reducing their list of approximately 250 statements to a core of "generic" statements as determined by selection criteria established at a second Lock Haven conference in May. Cross group reliability was determined with the final result being a reduction from approximately 4,000 to 403 statements of generic competency. Through the efforts of a 12 committee membership of group leaders, of which the author was a member, the 403 statements



were reduced further, after much heated discussion, to a final number of 63 generic statements. The statements were then published as an interim inventory(4).

This interim inventory is designed to be a research and development instrument. It dictates neither certification nor minimum standards for pre and inservice teachers in Pennsylvania. In my mind it is intended to reduce the "gap" in teacher education programs and implicitly counter the charge of Harry S. Broudy that in Performance-Based Teacher Education the performance unit (here stated as a generic competency) is a matter of indifference, that is to say, the number and characteristics of the performance units vary from one program to another. While the generic statements in the Interim Inventory represent a synthesis it in no way was intended to limit individual thrust and direction setting in each of the 63 higher education institutions in Pennsylvania. In fact, the generic statements represent a product of the first of a five stage process in Pennsylvania's Competency-Based Teacher Education Program. Stage one includes continuing competency definition in generic and specialized form. Stage two involves continuing program design with stage three emphasizing continuing program development. Stage four places emphasis on the design of competency assessment. Stage five results in the explication and implementation of a program approval process for institutional endorsement as competency based by the Pennsylvania Department of Education. Projected estimates of the entire five stage process range from five to eight years. Many of the ideas presented to this point are specific to the Pennsylvania CBTE movement and generalizations are not implied to all of teacher education.

#### B. Direction as seen from the University Department's position

Two major departmental missions exist for our faculty in elementary education at the University of Pittsburgh. The first is to individualize the education of new teachers for a changing society. The second is to study and research elementary school environments, the CBTE approach to teacher education, and alternatives to inservice education of school personnel.

Both are designed to directly provide and develop better elementary programs for children in this region of the Commonwealth of Pennsylvania. Nested within these stated missions are basic assumptions that must also be made explicit. Doing so provides a conceptual bridge between goal and practice. It is important that the Pennsylvania Department of Education, Funding Agencies, school districts, faculty, prospective students, and community be aware of these assumptions that guide the daily operation of the several elementary programs in the department.

#### Assumptions related to learning

Learning is a highly individualized process characterized by the interaction of humans with differing capabilities and within many environments. Self-awareness and survival are principle motivational sources of most learning experiences. Matters of feeling, attitude, belief and personal convictions are legitimate dimensions of learning which should be manifest in the child's school experience. Styles of learning can be identified to the extent that procedures, resources, and processes can be differentiated to insure success by learners.

#### Assumptions related to program

Programs for children and teachers should exemplify the broadest range of human experience. Cultural diversity, justice, and responsibility should be explored in each community. The means by which children and teachers experience the program contributes significantly to the outcomes.

#### Assumption related to staff development

The adult staff should perceive themselves and others as active participants in the learning processes. Intensive interactive processes among adults in the school can prevail and contribute positively to the learning processes with children. Decision-making prerogatives can be decentralized to include those who have direct responsibility for the implementation of program with children.

Being and becoming informed contributes to the development of adequate persons.

The quality of decision-making is influenced by many factors including the nature of information held by the participants and the substance of interpersonal processes.

#### Assumption related to community

A parity quest should be promoted among the many representative groups within and without the school to allow the participants to become involved with the significant issues of the elementary school. Children, teachers, parents, administrators, other staff, university students and faculty and significant community agencies should be considered in any total change process.

Programs currently existing in the Department of Elementary Education are Early Childhood Education, pre-service block, student teaching, Master of Education, Master of Arts in Teaching (Intern Program), Post-Master's Program for clinical faculty in Teacher Centers, Elementary Principalship, and Doctorate. Each program and the support setting in which it operates, continually strives to achieve and implement the aforementioned assumptions. Periodic program assessment by the Pennsylvania Department of Education is the current route by which the Department attains overall program approval. It is important that faculty recognize the need for periodic review of each program's objectives and should convene in open forum for full discussion of budget, personnel, and program priorities.

Basic resources in terms of personnel and money are channeled into on-and-off campus experiences. The Department of Elementary Education has been invited by schools in the metropolitan Pittsburgh districts to form a Clinical Education Network for the purpose of reformulating school experiences with teachers, children, parents, community, and administration. At times invitations are rejected. At times invitations to university faculty and students are taken back. At times invitations are accepted but the district acts in poor faith and effort. Fortunately these are the exceptions rather than the rule. Each member of the new educational coalition should advocate active participation by all in planning, developing, and evaluating programs in each elementary school.

Priorities of the newly developed Teacher Center network should relate to the promotion of the highest quality experiences with each child in the school, home, and the community. Imaginative pre and inservice teacher education in the city, suburbs, and rural areas should characterize the network operation. Research through directed observation, recorded data, selected feedback, and controlled development and implementation of materials are considered in developing a comprehensive evaluation system. Teacher education, pre and inservice, undergraduate through doctoral study is the main vehicle currently used by faculty in rebuilding the Elementary Education Department. The Teacher Center network best utilizes resources and provides maximum field experience capability for all university students junior level through advanced graduate study. Unfortunately at times, this is forgotten and the "politician participant" feels that a little time in many schools is the only thing needed to create favorable impressions that "someone cares." In my mind this attitude is frivolous, dissipating, and contrary to the notion that the best "politics" means doing a thorough and conscientious job many hours a week.

#### C. Approach to Implementation as seen from the School standpoint

That schools exist is in fact related to the rationale that society's institution, called the school, provides the child with knowledge, skills and "experts" in disciplines, to develop his competence in adapting to life's situations. People in society are now taking a hard look at teachers and programs in schools. Parent and community groups are more vocal and in greater attendance at school and board meetings. Just as the university has responded to the accountability of the State Departments of Education, schools are responding to evaluative judgments passed on them by groups demanding vested interests. The school response that typically arises is..... "where can we obtain additional resources and assistance?" The university or college of teacher education is usually in a position to deliver such assistance and resources.

Many schools choose to have student teachers, and their reasons vary between extremes of having another "underling" in the room to providing additional experiences for children. The present notion of a "Teacher Center" or "clinical education network school" embodies a deep concern for program development for children, staff development for teachers, and from these, improved environments for teaching and learning. It should be a goal that in the center as teachers create learning environments, they use and develop skills and techniques appropriate for dealing with the dynamics of groups as well as the competencies which promote individualizing of learning. These skills, techniques, and considerations focus on the following elements:

- (1) Group processes and pattern, groupings of children,
- (2) communication and decision making,
- (3) roles within the classroom,
- (4) the organization of learning laboratories,
- (5) the promotion of self-appraisal practices,
- (6) the physical environment of the class, and
- (7) the social and emotional climate in the classroom

The organization and development of Reading, Mathematics, Social Studies, Science, and Language Arts Programs in the elementary school represents one dimension of professional study essential if teachers are to participate in the decision making process of the school. Program development involves the examination of teaching methods, materials, structure, competencies and designs by which these areas and processes may be evaluated. Selected elements in program development are identified as:

- (1) techniques, methods, and principles of teaching,
- (2) establishing nexus between theories of learning and teaching,
- (3) curricular structures,
- (4) instructional designs and concept development,
- (5) creating problem solving conditions, and
- (6) evaluative strategies.

As teachers become more active participants in the development of programs and processes within the schools, appropriate training experiences should be planned for the purpose of promoting their awareness and competency in the areas under consideration. The relationships between this training and the institutional changes which grow out of these processes need to be examined. Processes of planning, implementing, and evaluating are representative of the competencies used by teachers and administrators as they consider changes in the total school environment. Therefore, the phenomena of institutional change are studied by the staff as they experience those processes designed to promote change, of which program development is one, in the schools. The nature of inservice is expanded within this rationale to include the following elements:

- (1) change strategies within the school,
- (2) school and personal philosophy,
- (3) the teacher as learner,
- (4) identification and use of consultative resources,
- (5) models for the evaluation of training activities, and
- (6) planning of long and short range experiences.

The concerns with staff development transcend the barriers established by pre and inservice trends and practices. Within a teacher (and learner) center activities usually designated as preservice may be inservice for some practicing teachers. The preservice through inservice efforts now blend into a continuum with aforementioned elements in program and staff development as the areas of focus prescribed for or selected by "certified" and "pre-certified" personnel.

In the clinical education network Teacher Center much more than "interaction" occurs. I suppose the term "transaction" might be used to signify the "give and take" or "negotiations" that take place between and within school and university personnel. I will use the word transaction to connote "political" negotiations involving trades or exchange of time, efforts, resources, and personnel. Interaction will connote subtle and overt, non-political "niceties" used in communication with colleagues and children.



I make this distinction because "transaction" occupies a non-subordinate, a non-subjugate, position with respect to interaction. Both transaction and interaction imply sharing and building. In a viable "teaching-learning" center both exist for the benefit of all participants. The following recommendations identify specific elements and personnel practices in transaction endeavors:

- (1) Identify university liaison personnel willing to work in a school "Teacher Center."
- (2) Identify school personnel willing to work with pre-service personnel.
- (3) Establish credit and cash banks within the school district.
- (4) Develop a professional library in the school building.
- (5) Conduct inservice workshops.
- (6) Work with "resident" teachers offering methods courses to student teachers.
- (7) Establish a "site committee" composed of teachers, community, parents, and students.
- (8) Use school facilities for school-university training.
- (9) Pay Master degree interns half of a beginning teacher's salary and full teacher benefits.
- (10) Allow special admittance of resident faculty in the Teacher Center to a Master degree program.
- (11) Develop participation of community, university, and school faculty in both university and school policy.
- (12) Enter into consortial agreements with other teacher training institutions.
- (13) Work with local and regional professional education organizations.

#### D. Outcomes as seen by the Community

As the child acts in several environments, his growth and development reflect these experiences. Simultaneously, the institutions are affected by these interactions and transactions. Teachers and parents who are alert to the nature of these respective institutions, the dynamics of their interactions, transactions occurring, and the influence of selected institutional elements on them use skills and background information which extend beyond nascent notions of teaching and learning competencies. The home school-community relationship exists because of physical placement and the clientele.

Focusing on these relationships brings certain elements into view:

- (1) The cultural dimensions of the home, community, and school,
- (2) social dynamics of the community,
- (3) processes of transition between home, school, and community,
- (4) social agencies, and
- (5) parenthood.

These perceptions along with formal involvement of the school and community aid in the development of a "community of purpose" and pride with responsibility for accepting the consequences of joint decisions. This is a basic tenet of the notion of decentralization, an often misunderstood concept.

#### E. Benefits Existing for the Children

The ultimate goal of inter-institutional effort rests in improved programs and humane relationships with children. Although the term "individualized" has been bandied about it is expressive of the results sought for in a child's learning experiences.

It is obvious that a discrepancy...a dis-equilibrium exists between what the learning environment could provide and what, in actuality, exists in many schools. An adaptive environment provides multiple attainment paths in which specific and subtle differences between individual resultant of differential backgrounds are realized. Interactions and transactions are assimilative and accommodative. In an adaptive environment, the abilities and motivations that each child brings to school must be understood in detail and educational alternatives provided that take into account these talents and styles of performance. The expanded notion of teacher roles will hopefully enable individuals to operate not in isolation but to precipitate various resources for use in the development of an adaptive rigorous learning environment for children.

### III. CONSIDERATIONS IN THE EDUCATION OF TEACHERS OF SCIENCE

#### A. Press from professional organizations

Many individuals in life adopt a "jump on the bandwagon" attitude towards techniques, slogans, and especially educational critics. Bandwagon efforts usually falter and become non-contiguous because the environmental variables are either underestimated or worse, not considered. Efforts erode to constant concern for problem alleviation of whatever practices exist rather than for improving and building on those practices.

Many times the products of a bandwagon effort result in new names for old practices rather than new concepts and new practices. For many individuals in CBTE movement it is the former while for others it holds great promise in the metamorphosis of teacher education. An "early" recommendation was made by Alan M. Voelker (5) for a competency based teacher preparation approach consisting of five major components:

- (1) Independent study questions
- (2) Instructional packages
- (3) Open activities laboratory
- (4) Peer-group teaching
- (5) Increased school involvement.

Of the five items listed above only two have achieved recognition in the literature. The notion of instructional packages has been derived from program packages in science such as SAPA, SCIS, ESS, etc. Within CBTE, objectives are stated as competencies to achieve and activity is isolated usually to the teacher education institution. What the prospective teacher might be expected to accomplish is a set of prescribed or self-selected activities matched with objectives stated in competency form.

The basic notion that fails to materialize is that of a "whole repertoire of teaching models" nested within a role theory framework. A necessary precondition to this basic notion is an environment that best allows the individual to develop competencies reflective of role expectation in the educational network. Increased school involvement of preservice personnel with concomitant demands placed on preservice training by inservice teachers is now being realized. The National Science Teachers Association meetings display an increasing awareness of the CBTE movement. Just as the idea of individualization caught the attention of educators so has CBTE. But as of yet statements of competency for science teaching are elusive or non-existent. There are or could be a very large number of them if one (hopefully many) individuals were to compile lists of science teaching competency statements. This has neither been nor appears to be a central focus of NSTA. The author is unaware of any official mandate to identify such a list.

Since the NSTA membership does contribute to the focus and format of national meetings, it can be said that as an issue it occupies the discussion and thought of teacher educators. The author has found the subgroup meetings of the Association for the Education of Teachers in Science (AETS) much more focused and concerned with the issues of Competency Based Teacher Education. The outlook expressed by the science educator membership of AETS appears to run from cautious optimism to negativistic concern about the feasibility of CBTE. Representatives of the New York University TIT Project in Science and Mathematics Education stated their position as follows:

"If we could define teaching behavior that demonstrably contributed to student achievement then a PBTE Program would be highly desirable. But given that there is little agreement and almost no data as to what to teach, how to teach it, or what the needs of students and/or society are, it seems extremely unlikely that an attempt to design a performance based teacher education program can reflect anything more than the designer's biases and it is our feeling that it is dangerous to give what is, in reality, a subjective program a cloak of objectivity (6).

In a more recent AETS meeting in Detroit, Michigan a "rap session" among 25 individuals was held to discuss teacher education in science. An abstract of that session revealed the feeling that the prevalent model of methods and related education courses followed by student teaching was argued as being ineffective. Earlier contact with pupils, as part of the concept, with student teaching as a culminating experience may be viewed as a future aspect of an experienced based curriculum. "Teachers in the group would not accept the notion that performance based curricula would be an effective model. This may have been due to the confusion over the meaning of the idea. Most in the group felt that performance based teacher education was a viable concept and would no doubt have impact on future science teachers, their certification, and continued professional growth." While I am sensitive to the possibility of overgeneralization I feel that attitudes reflected in the above statements, currently persist and affect the momentum of efforts in CBTE.

## B. AAAS Guidelines and Standards

In February of 1969 the American Association for the Advancement of Science with its Commission on Science Education published standards and guidelines for the preservice science education of elementary school teachers (7). The document states that the guidelines must be general but, because of this, they are subject to various interpretations. Three years later in summary of discussion (8), the problem is stated that the guidelines lack a unifying philosophy and supports contradictory changes. It is this author's contention that the charge is more appropriately leveled at competency based teacher education. The guidelines and standards are reported as failing to do the following:

1. Delineate sufficiently the competencies which teachers need.
2. Encourage greater sensitivity in interpersonal relationships between teacher and student.
3. Recognize the need for clinical professors and methods courses rather than the reduction of teacher preparation to internships under master teachers.
4. Recognize the special problems of beginning teachers who need opportunities for success and experimentation.
5. Effect change in a realistic manner.

To expect the guidelines and standards to do anything other than the delineation of sample competencies is unrealistic. As such they represent statements designed to badly initiate an even broader "ecological system" with divergent components connected under the rubric of "preservice education" to produce a convergent focus on competencies. Although the spirit of intent is evident the translation into statements, competency or otherwise, is limited in scope and depth. It places the burden on the reader to design and implement strategies lent direction by the standards and guidelines. Team teaching, relations with the school and community, relations with children, instructional management, continuous learning, scientific knowledge and the processes of science, attitudes towards science, individualization, and resources represent the areas of concern in its broad spectral analysis.

In examining the above concerns it becomes trivial to attempt to identify competency statements in the behavioral style and format. It appears to be much more appropriate to think of the larger setting in which the incident behaviors occur and the roles and role strain that generate these behaviors. That is the focus of this discourse. To begin with the statement of competencies implies a primary concern over "target" behaviors with implicit and vague distinctions of settings, social situations, and position set in the background. It is suggested that to obtain a more realistic approach to CBTE one must consider the background, cognitions, characteristics of persons, the persons themselves, and levels of role definition BEFORE identifying or specifying statements of competency. In this manner one can not only modify the types and nature of specific statements but create the "big picture" or "gestalt framework" from which adaptive statements or objectives can be derived.



### C. Teaching roles, models, and competencies in perspective.

Before the author begins a discussion of roles and the generation of competencies within a role theory framework it is important to define terms and delimit certain assumptions:

#### DEFINITIONS

<u>Role -</u>	An operational classification of an individual's behavior that represents an assumed complex of mental and ethical traits distinguished by quality.
<u>Competence -</u>	The ability to acquire and demonstrate strategies and skills of teaching as well as related behaviors all of which are derived from a role orientation.
<u>Relatedness Factor -</u>	A value judgment placed on a set of teacher-learner competencies as to their being immediate, distant, or of remote consequence to one another.
<u>Performance criteria -</u>	Categories that reflect a quantitative and qualitative measure of behavior.

#### ASSUMPTIONS

Role categorization or classification implies a functional rather than realistic differentiation. The sum of all roles engaged in, professional or otherwise, do not constitute the total of the individual. There is interaction between roles. Functional differentiations are intended only as a hypothetical construct through which analysis of demands facilitates the determination of curriculum design for teacher preparation. To adequately define each proposed role requires a categorization and an analysis of the demands inherent in the situation in which the individual operates. Role demands vary with situational factors. Preparation should revolve around (1) specific disciplines, here science, through which principles are available from which operational hypotheses are derived, (2) a range of environments in which preservice experience can be provided, and (3) flexibility, role identification, and various cultural and situational distinctions. Role demands can be altered by the incumbent. Specialization to meet role demands in a preparation program is arrived at after the categorization and analysis of such demands and after an evaluation of those demands which are deemed valuable on the basis of professional judgment.

Role theory appears to have attained popularity because of its many useful connotations rather than its specific denotations. It is not however, a nebulous concept. For all intent and purpose this perspective of role theory concerns patterns of behavior which are common to sets of social actors and the cognitive phenomena which underlie the patterns. The statements made here by me (subject) with respect to roles represent cognitions about teachers (actors/objects) in the real world as they relate in a social way with colleagues and children (targets):

The characteristics now described represent events bounded in time, consisting of a meaningful action taken by a given 'object' person. That statement defines behaviors and they (the behaviors) are active, volitional, and usually directed towards social targets. Statements of teacher competency when operationalized should be evaluated in terms of the 'target' behavior. In some the relatedness factor would be high i.e. The consequence of the teacher's behavior can be seen immediately in the actions or behavior of the target. Oftentimes the relatedness factor is remote i.e. Consequence of the teacher's behavior is seen in the 'target' after a long period of time.

#### ROLE CHARACTERISTICS

##### Interacting Agent-

cares for others; forgiving; has faith in others; never gives up; has patience; is 'other' oriented; facilitates or directs behavior.

##### Instructor-

specifies learning goals; diagnoses the general state of the learner; plans and prescribes for the child on long and short term basis; assesses progress of the learner; motivates learning.

##### Instructional designer-

develops instructional resources; establishes a learning environment.

##### Transforming agent-

develops and implements group process strategies; effects teaming; promotes professional-political action; develops and implements change strategies where appropriate.

##### Individual-

promotes and practices self-appraisal; self-control; self-direction; self-management; self-awareness; self-actualization.

##### Social 'technologist'-

develops an inquiring attitude in others; effects communication; promotes continuous learning; identifies problems and ways to solve them.

It is not the purpose of this paper to examine the characteristics, discuss the validity of the selected roles, or ascertain the principle of categorization used by the author. The roles are stated with the conviction that they will serve as a "conceptual organizer" for the interweaving of competencies, phasing of teaching models (9), support setting considerations, principles of reaction, and aspects of the children and the learning environment.

D. Proposal for a Science Teaching Education Program in Individualization (Step-In): Preservice

The reader is reminded of the assumptions made with respect to roles as stated previously. It is with these assumptions that the following set of roles is described and made "operational" in the generation of competency statements. Reference is made to the AAAS standards and guidelines as an additional input factor considered in the generation of competency statements.

This proposal and related role characteristics represent an effort to redefine, refocus, and develop strategies for individualization aimed at improving elementary school environments in which science teaching and learning take place. The "improving of teaching" will be attempted through the ultimate development of teacher competence derived from roles. The "improving of learning" will come about as a result of the teacher's awareness of the student's total participation in action-based activities within the learning environment. As teachers of prospective and practicing teachers, we have the responsibility to practice or at least provide experience for what we preach. We must use any and all resources available to enhance a child's learning of science. The learning experiences we provide for teachers must likewise reflect a use of any and all resources available to enhance the teachers' "teaching" of science. The concern is with three variable interactions operating in the classroom. The first variable is the teacher's competency to promote and maintain individualized learning experiences with a child. The teacher develops competencies to promote student competencies. Teacher competencies might range from "specifying" learning goals to enhance self-development and includes such skills as focusing, modulating thinking activity, structuring the learning environment, inquiring, as well as management of resources. The second variable deals with student competencies developed

within the learning environment. These competencies might range anywhere from conducting an investigation to coping with and solving problems. The third variable deals with the design, development and management of the learning environment using learning resources for student use. Resources are either commercially produced or teacher made with individual differences in mind. The learning environment allows a child to assimilate natural and physical phenomena through the use of materials and stimulates accommodation to new problems and situations. This accommodation effects logical thinking structures formed by experiences which in turn develops a stabilization or equilibration point in the development of a particular concept. This represents an adaptive model viewpoint of education where assimilation of phenomena and accommodation to new situations occurs with the greatest ease. This represents a translation of Piaget's notion of intellectual development to assumptions related to experiences in a learning environment. The vehicle in approaching this model of education is very much different than what has been practiced in the not too distant past. The adaptive model assumes activeness, as opposed to passiveness, on the part of the child. If the role has changed from passive to active learner, the teacher must change his role. In this environment the teacher and student assume appropriate and complementary roles around learning and decision making. The roles generated and subscribed to are individually or socially oriented. If a teacher assumes the philosophical orientation, his learning environment should reflect this position.

It is obvious that a discrepancy.....a 'dis-equilibrium exists between what the learning environment could provide and what, in actuality, exists in many schools. To provide for an adaptive educational system is the goal for which we should be willing to and must ask penetrating questions. How can a teacher match patterns of individual abilities and styles of performance in certain situations to the method, substance, planning of instruction, and development of learning environment?

How can instruction be accommodated to the interest, motivation, and reinforcement levels of the individual? At the risk of sounding pessimistic my observations about programs, teaching, students, and use of the learning environment lead me to the following conclusions:

1. Teachers expect students to assimilate teacher pre-selected concepts presented many times on too abstract a level.
2. Little attention is paid to intellectual development in terms other than that expressed by achievement/test scores, type of activity engaged in, or activities completed.
3. Teachers expect students to accommodate their thinking structure only on a very low level, that is, through imitation.
4. Communication patterns are developed and encouraged between and from teachers to student rather than between student and student.
5. Many learning environments contribute to the self-actualization and autonomy of the teachers only.
6. The curriculum and its organization oftentimes presented represents a frustrating experience for students who feel they must learn everything and for teachers who believe they must know everything in the curriculum.
7. The idea that all problems have an answer or can be solved is a misconception frequently developed by teachers and children.
8. A child's contribution to the development of his learning environment is severely limited.
9. The present focus on teacher competencies is to help the teacher survive in the school rather than to develop student competencies.
10. Individualization is conceived as a one-to-one process which, if perceived as only being this, is difficult to achieve.
11. Students will initiate their own learning only to the extent that teachers allow them to and on an expectation level coincident with the teacher's.
12. Many attempts at individualization reflect the philosophy that there is only one way to individualize.
13. A misconception, dangerous to attempts at adapting individualization, exists in that many believe an individualized program, commercially produced, is the only input necessary.
14. Many so-called attempts at individualization simply replace the teacher with the student and do not attempt to change traditional, or uni-modal, methods of learning.

15. Many teachers do not allow students or provide them with opportunities to identify and select alternatives for learning.
16. Expectations of achievement or mastery of objectives is for the large part set by the teacher and his instructional program.
17. Diagnosis and prescription are not considered a part of the student's competencies. They come from the teacher alone to enhance the attainment of behaviorally oriented content or academic process objectives. Diagnosis and prescription are competencies a student is expected to develop by watching the teacher rather than becoming involved in with the teacher.
18. For the most part attempts at individualization originate with either the teacher or administrator and usually result in the edict "...thou shalt individualize..." without attention paid to individual differences in teacher personalities, knowledge, and commitment. Efforts at developing strategies of individualization succeed when adequate provision is made for staff development and in-service education.
19. Some "so-called" individualization proceeds when the student has accrued time tokens for finishing "prescribed" material at a fast rate.
20. Use of parent and local community committees for consulting and advising is seen as frivolous and inappropriate for the process of individualization.
21. Individualization is seen as a process separate from socialization rather than developed through socialization.
22. Evaluation of the strategies for individualization is usually an internal rather than an internal and external process supported by the institution.

It is obvious that the term individualization is used quite often in the literature. It is not the function of this paper to define the term but to impress upon the reader that the process of individualization (with its many connotations) represents the focus of the efforts in the role to competency development scheme for teachers and students.

The support system in which the pre-service teacher operates is important because it "supports or nurtures certain behaviors either intended or not intended as the case may be." Early efforts to control the support system for pre-service education resulted in laboratory schools. With the advent of social awareness and increased involvement in "real world" school problems some educators began to move out into the schools and now assume active roles in program and staff development activities. Pre-service education has been most frequently criticized from the standpoints of its nature and staging of classroom teaching methods experiences.



When the approach was too heavily oriented towards theory on campus, the teacher practitioner was not pleased. When the emphasis was strictly on the practical "how to" strategies in the field, college faculty "devalued" the Program. The current trend is towards orchestrating the mix of theory and practice in public school teacher centers. Lack of communication between and among college faculty and cooperating teachers along with rigid compartmentalization of math, science, social sciences, reading, and child study contributes to repetitive experiences, conflicting theory, bewildered students, and frustrated cooperating teachers. Being open to valid criticisms, helping pre-service teachers enter meaningful educational experiences sooner, exploring the implementation problems associated with the active integration of curriculum content areas, and building communicative partnerships with classroom teaching teams are essential ingredients in the support system.

Specific pre-service experiences should allow students to:

1. provide weekly clinical experience where the pre-student teacher can observe and assist teachers;
2. explore inquiry, content, unit integration, and logical planning processes with children and cooperating teachers;
3. discuss, plan, test, and assess an array of approaches to instruction as a member of a team of educators utilizing the full range of experience represented by a team of educators
4. study children, classroom behavior dynamics, and the balance or imbalance of the curriculum as evidenced in a Teacher Center;
5. acquire a repertoire of specific teaching strategies unique to reading and language arts, science, mathematics, and social studies;
6. become aware of self, the uniqueness and the identification of teacher roles;
7. become aware of the minimal generic teaching competencies necessary to the individual's successful entry into teaching;
8. initiate and maintain a professional dialogue with peers and significant supporting faculty on campus and in the Teacher Center;
9. assume primary responsibility for creating and maintaining a data base about individual candidacy; and
10. develop the skills with guidance in assessing data of candidacy leading to self evaluation and the design of a professional growth plan.

I would like to think that consideration of the characteristics and support systems operating and influencing pre-service education would represent an "environmental" approach more akin to a developmental model as opposed to a "sequential passage through hierarchical experiences" as evident in a strict associationistic model. The problem for the teacher educator becomes one of how to match the experiences with the support system and characteristics to optimize the individual's learning experience. In other words, what is a possible design and focus for pre-service experiences that takes into account the student's needs and professional growth? The following design represents an organizer for a pre-student teaching methods course that integrates or focuses on different teaching models for science and social science. The design is based on the assumption that an individual must feel a need as determined by a discrepancy in his perception or style of implementing certain roles, teaching models, and competencies. Generating or reacting to value statements represents the first step in the series of adaptive experiences. The statements then provide a baseline from which comparisons are made to either the pre-student teacher's perception of teaching or his method of implementing instruction in science. Different situations with different individuals call for a role identification and the implementation of different models of teaching and competencies derived from the roles and models. Discrepancies arise and the level of self-realization the greater is the awareness of needs. Once the needs are realized, the pre-service student proceeds to establish learning goals of immediate or long range stature. Limits have been imposed with respect to the range of roles and models but not with competencies. For purposes of review the roles covered in the "competency block" experience for science (and social science) pre-service methods block are: individual, instructor, instructional designer, interacting agent, transforming agent, and social "technologist". The pre-service "pre-student teaching" course deals heavily with the role of instructor and instructional designer. This is not to say that other roles are not examined it is just that the parity agreements with the school (teacher center) have resulted in a social system and support setting maximally conducive to

to the development of these two roles. It is the author's perception that the interacting agent, social technologist, and individual roles are better supported while the student is "student teaching. Role development is cumulative and differences in the form of unobtrusive measures can already be seen in some students currently in this system. The certified teacher's (in-service) status as currently viewed in the school provides the framework or support system for the development of the transforming agent role. Needless to say different teacher centers in our own Clinical Education Network, spark different role developments and are themselves at different levels of sophistication, i.e. poor to good with respect to program and staff development. It is over a long period of pre-service in-service experiences that roles and competencies are developed.

The pre-student teacher designs developmental experiences, most of the time with the instructors, at beginning, intermediate, and advanced levels which correspond roughly to the assimilative, accommodative, and adaptive levels posed in the Piagetian paradigm. The last stage is perhaps the most novel with respect to course outcome. Usually the end result(s) of a course or set of experiences is a product or output assessment of what a person has achieved with respect to instructor pre-selected goals. Since the pre-student teacher has determined his own needs as well as long and short term goals and experiences the outcomes of the course had to be restructured to accommodate this behavior set. Another notion to be considered was that the pre-student teacher might view the end of the course as a terminal rather than a beginning point in the further development of roles, models, and competencies. The individual is required to identify the competencies he 1) has attained and 2) would like to attain in the science/social science student teaching methods experience. This means that the pre-student teacher will have identified the competencies and roles so as to design the experiences on which he needs to build additional competencies. The stepwise procedures used in the course (see figure 1) involve the student designing a contract for each of the teaching models. The contract itself is composed of seven essential components stated as follows:

- "1. From the value statement sheets identify your learning experience objectives for adapting the teaching model.
2. Describe how the teaching model objectives stated above are related to the teacher competencies you plan to develop through short/long range planning.
3. Identify activities you intend to do to develop the competencies under the model.
4. State resources to be used in your learning experience.
5. Identify quantitative and qualitative components of the evaluation process for your learning experience objectives.
6. Record your long range competency needs.
7. Identify associated learner competencies that the model promotes."

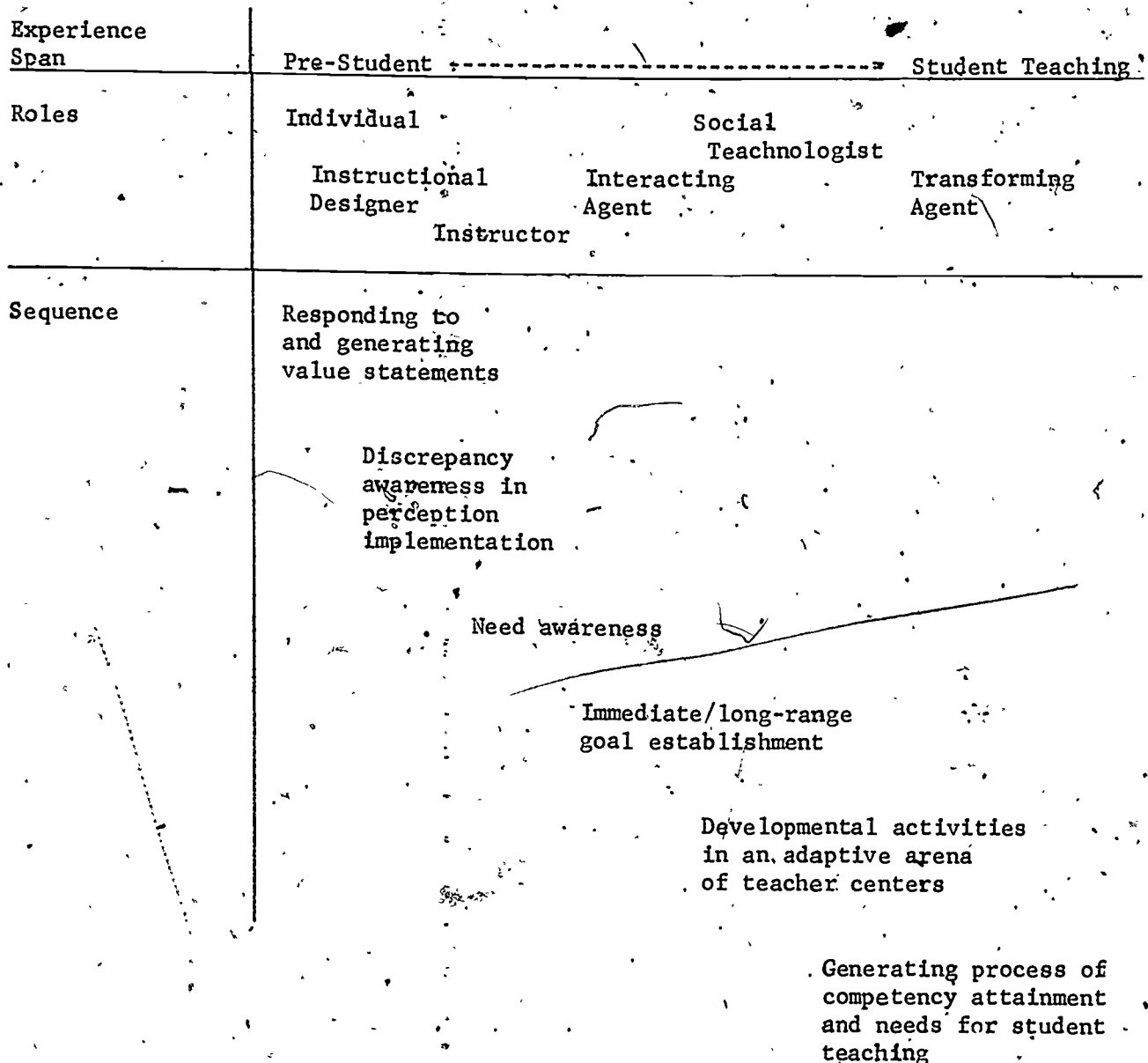


Figure 1. Developmental sequence of experience for role based competencies at the pre-service level.

Contracts are classified as acceptable or non-acceptable on the basis of completeness in addressing each of the seven points and just delineation of experiences as determined by the student and instructor. Contracts are then implemented and evaluation of the fulfillment of the contract is made. Throughout the phases of the experience quantitative and qualitative components are stressed. Finally as a result of contractual experiences the student identifies activities and competencies he expects to develop in the next term of pre-service training which is called "student teaching. By following such a plan it is the desire of the course instructors to begin shaping the social system, type of experiences, and continuity of training for elementary school teachers. Redefinement, continued evaluation, and further research is needed to fully examine this role approach to the development of science teaching competencies. A real test of "adaptability" for pre-service teacher methods instructors will come about and hopefully some process of evolution rather than revolution will become evident.

#### IV. SUGGESTIONS, IMPLICATIONS, AND WHAT COULD BE

The statements made prior to this section were necessary and are preliminary to what now follows. It is an attempt to integrate the notions of roles and competencies within the assumptions of a process directed towards the individualization of teacher education in favorable support systems using the AAAS Guidelines and Standards. As such, the Standards and Guidelines presented in the preliminary report are not changed but used within a "competency" and "environment" frame of reference. The resultant effort of this integration is what provides the "perspective" alluded to in the title of this presentation.

Certain letters and numbers will be marked with an asterisk. These items are verbatim or modified statements taken from the Standards and Guidelines Preliminary Report around which other statements have been added. The bulk of added statements with respect to Instructional management, relationships with children, and team teaching are derived from preliminary working drafts of papers that led to the University of Pittsburgh's U. S. O. E. Model for the Training of Elementary School Teachers (10).

## A. AAAS Standards

The Standards are clearly designed to establish appropriate conditions with respect to teacher training experiences at the higher education institution. Where the word "institution" assumes this physical denotation in the Preliminary Report it should encompass not only the college or university but also the Teacher Centers. In this sense, the experience would be part of the Clinical Education Network and would increase the opportunity of involvement with adequate facilities and materials as well as individualized instruction matching the needs of the pre-service teacher with the environment of the school. Rather than provide separate facilities, resources for preparing teachers can be shared, I present one strong statement of caution. Schools are stagnant and hence, are not what they should be. Parity agreements can be made for two reasons; first, to improve the program and staff experiences in a school and second, to improve the training experiences of pre-service personnel in the Teacher Center. The ultimate goal being the development of improved learning experiences for children in the school. If the focus on program and staff development is "poor" to begin with an impacting of university students in a school would be disastrous in some cases but beneficial in others. With respect to full or partial impacting models I do not support one or the other for it depends entirely on the situational parameters and participants. If the focus is on pre-service training, i.e., places to take pre-student and student teachers, any over-emphasis on this stance could and usually alienates college or university faculty and cooperating teachers and administrators in the public school centers. In essence parity agreements need to be "balanced" and conducted with justice for all involved. With these thoughts in mind the standards are now presented.

### \* STANDARD I

The institutions should have at their disposal:

- a. laboratory facilities which will accommodate pre-service student activities ranging from predetermined professor conducted exercises to student constructed experiments; and



- b. science equipment, materials and resources used in well equipped elementary schools.

\* STANDARD II

Institutions involved in the preparation and development of teachers should make every effort to allow for individual differences among those teachers by planning or allowing for experiences so that they may progress at different rates and by giving credit in completing minimum program requirements for competencies acquired before, during and/or after certification.

B. AAAS Guidelines

The guidelines represent those dimensional parameters that nurture the development of appropriate competencies. This effort by the author is not designed to categorize, in an absolute sense, "statements of competencies. It is designed to provide a framework from which competency attainment and formation proceed to develop the ethic of "the 'science' of educating" in conjunction with the "art of teaching", an issue that needs to be explored in the C/PBTE framework. For sake of coherency the reader must integrate the guidelines with the role to competency notion. At this time, assumptions are made to provide additional insight for the reader,

\*GUIDELINE I: Science experiences for elementary teachers should develop those attitudes in teachers which result in improved teaching of science in their classrooms, a more scientific approach to questions which they face in their daily lives, and an interest in science related activities.

ROLE:  
Individual

ASSUMPTION: Attitudes are developed by each individual as inquiry and self-appraisal become a patterned mode of behavior.

\*A. The teacher will demonstrate confidence in his ability to make reasonable inferences by doing so when presented with empirical data.

I. The teacher will demonstrate and assist children and peers in:

1. using special methods and materials in achieving mastery in adaptive thought processes;
2. identifying or discovering problems;
3. desiring problem solution;

4. identifying approach made to problem solving;
5. achieving solution of problems;
6. acquiring curiosity and openness of attitudes and stance;
7. developing effective questioning technique;
8. gathering supporting evidence;
9. analyzing data;
10. drawing inferences and generalizations
11. associating new knowledge with "old";
12. analyzing strengths and weaknesses in logic and thought processes;
13. encouraging children to show curiosity and inventiveness in science by helping them to design experiments to answer their questions.

\*B. When judging the validity of a statement which is presented as fact, the teacher will rely on empirical data and inferences derived from evidence rather than authoritative pronouncements.

I. The teacher will demonstrate and assist children and peers in:

1. developing effective habits of consideration for new ideas and experiences;
2. appraising understanding, empathy, and communication;
3. exploring new conceptual and experimental realms.

\*C. Given a statement or circumstance that seems inconsistent with the body of science, the teacher will demonstrate his belief in the self-consistency of science by reserving judgement or attempting to test its validity.

I. The teacher demonstrates his personal capacity to:

1. delineate comprehensive growth objectives;
2. implement personal dimension inventories;
3. articulate personal characteristics;

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\*Items indicated thusly are verbatim or slightly modified statements taken from the Standards and Guidelines Preliminary Report and designate only the sentence or statement that follows.

4. analyze values and attitudes;
5. seek counsel wherever appropriate to personal growth;
6. modify personal behavior after interpreting evidence;
7. help children develop a personal appraisal and renewal system.

\*D. The teacher will demonstrate his interest in science by activities such as science reading and conducting experiments.

\*I. The teacher will read science related articles and books which are not required as part of a course.

\*II. The teacher will plan and conduct experiments on his own volition.

\*GUIDELINE II: The science experiences for elementary teachers should develop competence in the processes used in science as part of systematic, rational inquiry.

ROLE  
INDIVIDUAL  
INSTRUCTOR

ASSUMPTION: The instructor role focuses on behaviors related to realizing the unique features of the learner and the "matching" of learning environment characteristics with these features to build content and develop process skills.

A. The teacher will achieve and demonstrate knowledge of science processes.

I. The teacher will demonstrate and assist children and peers in developing competence in:

1. observing and measuring;
2. defining terms operationally when the need arises;
3. collecting and organizing data as well as describing the rational for the organization;
4. recognizing problems;
5. constructing hypotheses, inferences, and generalization;
6. interpreting data;
7. constructing experimental tests of hypotheses, inferences, and generalizations;
8. accepting, rejecting, or modifying a hypothesis, inference, or generalization based on new ideas and describe the basis of the decision;

- \*9. recognizing the need for additional information in some situations by searching out the information as designing an experiment;
- \*10. building, testing, and revising models;
- \*11. describing experiments orally or in writing with sufficient clarity to allow for experimental replication.

### CONTENT

A. The teacher will exhibit a strong, in-depth, knowledge and comprehension base in a self-selected science content area.

II. The teacher will develop a knowledge and comprehension base for children through experiences with:

- \*1. measurement;
- \*2. classification, categories, and criteria;
- \*3. composition characteristics and the structure of matter;
- \*4. interactions of matter;
- \*5. conversion and conservation of energy;
- 6. current socially related science issues;
- \*7. growth and reproduction;
- 8. evolution and genetics;
- 9. human development as a function of the environment;
- 10. manual skills using investigative equipment;
- 11. applications of scientific knowledge and methods;
- 12. scientific, social, and moral implications;
- 13. identification of objectives and structural aspects of each content or topic area;
- 14. creationism.

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It is the author's personal judgement that a more complete description of behaviors related to inquiry can be found in the Handbook on Formative and Summative Evaluation of Student Learning by Bloom, et.al. Although the behaviors are designated as student behaviors they represent those that should be demonstrated also by the teacher. This is strongly implied in Guideline II.

\*GUIDELINE IV: Science experiences should be selected so as to develop a capacity and disposition for continuous learning which the teacher should demonstrate by habitually engaging in science activities which will provide new information and experiences capable of affecting existing attitudes, ideas, and teaching.

ROLE:  
INDIVIDUAL  
  
SOCIAL  
TECHNOLOGIST

ASSUMPTION: Learning is continuous not only for the child but for the teacher. Self-development, motivation, and empathy are key elements to be nourished in the process of continuous learning.

\*A. The teacher will demonstrate his capacity for a disposition towards continuous learning.

I. The teacher recognizes personal traits affecting his learning process and uses these in examining his:

1. flexibility of behavior;
2. personal strengths and weaknesses;
- \*3. viewpoints on contemporary scientific issues and the learning process;
4. attitudes toward authority and supervision;
- \*5. ability to obtain relevant information on scientific and educational issues;
6. formulation of self-development plans to overcome limiting factors;
- \*7. action to eliminate gaps in his educational background;
8. modification of personal behavior after interpreting evidence of performance;
9. self-acceptance by being attentive and responsive to children and peers;
10. empathy and concern for children and their education;
11. objectivity and rationality in dealing with each pupil's intellectual, personal, and social problems;
12. confidence and emotional control in responding to pressures and problems;
13. flexibility in personality by providing for differences to pupil ideas, wishes, action, and feeling;
14. degree of uneasiness as children mention anti- or social behavior;

15. allowing children to vent and express strong personal feelings;
16. skills for intervention and non-intervention;
17. creation of anxiety producing learning situations;
18. expression of attitudes.

B. The teacher effects strategies to promote the motivation of learning by:

1. maintaining a cheerful positive stance;
2. approaching instruction with appropriate energy and enthusiasm;
3. relating prior experiences to new;
4. utilizing appropriate vocabulary for pupil background;
5. recognizing and accepting children's ideas, efforts, and contributions;
6. encouraging maximum child participation;
7. challenging children to search for meaning;
8. using pupil experience and knowledge;
9. providing diverse realistic and relevant activity to increase pupil interest;
10. encouraging pupil initiated group activity;
11. maintaining reasonable pace for group activities;
12. helping each pupil comprehend the motivational concept.

\*GUIDELINE V: The institution working cooperatively with schools should provide experiences with children and schools so designed that the teacher develops the skills required for effective instructional management of the science program.

ROLE:  
INSTRUCTIONAL  
DESIGNER

ASSUMPTION: The teacher provides an outstanding learning environment that is accommodative to the needs of the learner and overtly "matches" resources in the environment with pupil characteristics and goals.

A. The teacher, prior to interaction with the student (pre-active phase), demonstrates competence in planning resources into the learning.



environment, establishing a physical learning environment, developing strategies for individualization, making just curricular decisions, being prepared to diagnose the entering behavior of a child, making assessment statements, and specifying learning goals.

I. The teacher's ability to "specify learning goals" is evidenced by his competence in:

- \*1. identifying learning objectives appropriate to developing intellectual or process skills and concepts in science; and to
- 2. state learning objectives in terms of student behaviors;
- \*3. identify examples of objectives which illustrate systematic thinking;
- 4. interpret learning outcomes in terms of acceptable criteria of performance;
- 5. specify interrelationships among the various types of learning goals;
- 6. translate broad societal aims for schools into relevant learning goals;
- \*7. communicate learning objectives to pupils, teachers, parents, administrators, and community;
- 8. assist each pupil toward mastery of personal specification of objectives;
- \*9. identify and construct instructional modules or units which contribute to specified long-term goals of science teaching.

\*B. The teacher will demonstrate the organization and maintenance, during instruction, of a classroom environment that:

- \*1. schedules class time to allow for both groups and individual activities designed to accomplish specified objectives;
- \*2. demonstrates the introduction of a science activity in such a way that pupils are motivated to conduct investigations; and to
- \*3. create an atmosphere in which children participate freely in planning, carrying out, and interpreting results of investigations;
- \*4. use questions to assist children in conducting an investigation without telling them what to do or giving away the expected results;

- \*5. arrange instructional resources in the classroom to maximize pupil interaction with the materials;
- \*6. locate and use instructional resources available in the school and community;
- \*7. list sources of science materials other than local ones;
- 8. create a threat-free atmosphere;
- 9. establish a system for pupil self-direction;
- 10. provide multi-activity centers of high interest level;
- 11. stimulate free expression of ideas;
- 12. provide for an efficient flow of and orientation to new media and procedure;
- 13. provide a physically safe, healthy, and enjoyable environment;
- 14. establish a pattern of consistent consideration for individual rights;
- 15. provide the appropriate mood to reinforce quiet or active experiences;
- 16. maximize pupil success and the resolution of human and goal conflict;
- 17. manage orderly individual and group processes;
- 18. provide appropriate procedures for pupil feedback about the environment.

\*C. The teacher will demonstrate the ability to select and use a variety of learning strategies appropriate to various learning requirements by:

- \*1. matching appropriately materials, media, and activities to objectives for science instruction;
- \*2. identifying instructional materials and learning activities for different learner interests and capabilities;
- 3. translating educational objectives into pupil objectives;
- 4. preparing evaluative measures of pupil progress toward objectives;
- 5. applying knowledge of child development to curricular decisions;
- 6. specifying objectives of the learning task in terms of pupil behavior;

7. diagnosing each pupil's characteristics as a learner in relation to that task;
8. organizing oneself as teacher guide to support learner involvement;
- \*9. modifying planned strategies as a result of unexpected pupil performance;
10. insuring progress toward mastery by each pupil at an appropriate rate;
11. providing opportunities for active involvement for every pupil;
12. planning for pupil evaluation of quality and quantity of learning experiences;
- \*13. directing individual pupils to sources of information in conducting investigations not of interest to the entire class.

\*D. The teacher will demonstrate the use of various individual and group assessment investigations to determine whether specified objectives have been met. This would be evidenced by the:

- \*1. selection, or construction, and administration of assessment items requiring pupils to use concepts in new contexts and inquiry skills in new problem situations;
2. utilization of evaluative data to retain or modify objectives;
3. preparation to clarify objectives and evaluation procedures with pupils;
- \*4. distinguishing between acceptable and unacceptable responses to assessment items in science;
- \*5. use of various assessment devices to determine the degree to which pupils possess necessary prerequisites for a learning task;
6. recording of data to establish a relevant data bank of pupil performance;
7. testing of instructional hypotheses and evaluating results;
- \*8. use of results in planning subsequent learning activities;
- \*9. description of results of evaluations to pupils and parents so that it is clear whether the pupil is or is not making reasonable progress in science.

- \*E. The teacher will construct a sequence of learning activities on the basis of long-range objectives and knowledge of prior pupil performance.

The basic competencies reflect the following ingredients:

- \*1. select or construct alternative learning activities when pupils demonstrate that they have achieved the objective of a science activity prior to its being carried out and when prior instruction has been unsuccessful;
- \*2. construct appropriate and significant science activities for pupils whose lack of achievement indicates that they are not ready to continue with the rest of the class (Note: This assumes a norm-referenced as opposed to a criterion-referenced support system of evaluation);
- \*3. identify a learning sequence appropriate to the development of skills and attitudes which may emerge over a long (at least two-month) time interval;
- \*4. identify the information and conceptual knowledge prerequisite for specific science principles, laws, and theories and make reasonable inferences that these prerequisites exist before attempting instruction dependent on them.

\*GUIDELINE VI: The institution should insure that the teacher possesses skills required for effective human relations with children in the classroom by carefully screening candidates for the teacher education program and/or providing experiences in which students develop the required behaviors.

ROLE:  
INTERACTING  
AGENT  
  
INSTRUCTOR  
SOCIAL  
TECHNOLOGIST

ASSUMPTIONS: Teacher roles and competencies are developed relative to student roles and competencies in a supportive environment.

- \*A. The teacher recognizes the importance of individual children.

- \*I. The teacher will demonstrate the ability to accept pupils as individuals by responding to manifestations of individual differences in a controlled manner and by:

- 1. communicating effectively with individuals through oral, written, and behavioral processes;
- 2. stimulating pupil participation as a result of communicative style;
- 3. listening to pupil questions and reacting effectively in dialogue;
- 4. minimizing digressive influences;

5. helping each child to develop many aspects of his intellectual, social, and emotional being;
  - \*6. remaining relaxed with a calm demeanor in the presence of pupils who are creative, ask probing questions, and present challenging ideas in science;
  - \*7. exhibiting patience with the pupil who has poor manipulative skills in handling equipment or who is slow in acquiring process skills by giving words of encouragement or deferring required performance when the child shows evidence of extreme frustration;
  8. treating causes of deviant pupil behavior rather than the behavior;
  9. establishing individual rights and obligation among peers;
  10. involving pupils in self control patterns;
  11. minimizing pupil intimidation or embarrassment;
  - \*12. empathizing with students having personal problems by modifying requirements for that individual;
  - \*13. empathizing and appreciating children of divergent backgrounds and interests by listening attentively to and rationally examining the contribution of children from rural, urban, suburban, and foreign cultures;
  - \*14. demonstrating control over expressions of attitudes, feelings, and emotional reactions as shown by voice quality or facial and body gestures when responding to children's statements or questions about science;
  - \*15. demonstrating the ability to analyze reasons for unacceptable social behavior on the part of the pupil by inferring causality after viewing a real or simulated incident. Testing the plausibility of the inference by examining permanent records (real or simulated) and discussing the incident with a professional counselor;
  - \*16. demonstrating faith in the ability of children to make contribution by encouraging pupils to suggest answers to questions asked by other pupils;
  - \*17. assisting children in developing empathy for and a willingness to help their peers by suggesting ways that they may assist others or by suggesting understandable reasons why a child may have behaved in an undesirable manner.
- \*B. The teacher shows confidence and flexibility in relations with children.
- \*I. The teacher will demonstrate confidence and flexibility by:
- \*1. making reasonable alterations in teaching procedures in the face of unexpected events;

- \*2. failing to display frustration or embarrassment in the face of questions that he cannot answer;
- \*3. his calm demeanor in the face of ambiguity and unpredictable events which occur during the course of a science investigation;
4. allowing children to vent and express strong feelings;
5. displaying skills for constructive intervention;
- \*6. "relinquishing traditional controls in the interest of letting individual children and small groups work independently in science;
- \*7. assisting children in making plans for a science activity without making the decision;
8. assisting the child immediately by examples, questions, prompting, hypothesizing, clarifying, organizing data, and summarizing progress in the investigation;
9. orienting pupils to schedules for the learning plans, to any new materials or media they will be using and to any guidelines they will be following;
- \*10. assisting pupils in the conduct and interpretation of results from an investigation without telling them what must be done or what conclusions are reasonable;
11. providing, for those pupils who complete learning tasks without difficulty, alternate activities such as spontaneous fun things using mechanical, artistic, musical, and spatial interests.

\*GUIDELINE VII: Experience with children and schools should be selected so as to develop a sensitivity toward, and an appreciation for, the school and community and for individuals in the community including those whose ideas are different from his own.

ROLE:  
INTERACTING  
AGENT

TRANSFORMING  
AGENT

SOCIAL  
TECHNOLOGIST

ASSUMPTION: The teacher develops community involvement because the school operates within this "community environment." That involvement goes beyond just informing the community and includes the community participants in the making of valued educational decisions.



A. The teacher will relate with and to others with vested interests in the development of the school environment.

I. The teacher, in his relationships with others:

- \*1. demonstrates emotional maturity by behavior consonant with accepted social norms;
- \*2. demonstrates respect for the opinion of others;
3. assumes responsible membership in community and professionally oriented organizations;
- \*4. recognizes potential impact of mature collective professional action toward objectives;
5. effects and influences development of ethical professional standards;
6. effects and influences the establishment of relevant recruitment, selection, training, certification, and induction of beginning and "tenured" faculty;
- \*7. demonstrates confidence in his ability by taking considered action that may be criticized by others;
- \*8. seeks assistance and counsel from more experienced colleagues and takes appropriate action
- \*9. recognizes the personal concern of parents for their children, and shows respect and admiration for this concern;
- \*10. empathizes and appreciates individuals of divergent backgrounds and interests by listening to and rationally examining the contributions of persons from rural, urban, suburban, or foreign cultures.

II. The teacher, in his relationships with the community:

- \*1. demonstrates respect for local community values and institutions, even when they seem provincial or limited;
- \*2. demonstrates an active interest in local community affairs;
3. influences and effects financial support for education;
- \*4. effects relevant community involvement in policy and curricular objectives;
5. influences and effects systematic research and renewal of school programs;
6. effects appropriate professional evaluation schemata;
7. helps develop and supports effective separation of personnel unable to achieve or maintain competency in a just manner;

8. influences and participates responsibility in the support of democratic behavior;
9. supports evaluative measures of organization effectiveness.

\*GUIDELINE VIII: The institution should provide experiences which enable the teacher to function both as a science teacher in a self-contained classroom and as a member of an instructional team.

ROLE:  
INTERACTING  
AGENT  
INSTRUCTIONAL  
DESIGN  
SOCIAL  
"TECHNOLOGIST"

ASSUMPTION: Teaming is considered to be an effective way of planning for and evaluating the implementation of instructional activities.

\*A The teacher demonstrates the ability to contribute to team planning of instruction.

I. The teacher contributes to team planning by:

- \*1. negotiating and accepting compromises while developing science activities to be carried out by the team;
2. revealing the way he sees and does things;
- \*3. bringing out the essential patterns, motives, and behaviors in a situation in order to receive clear and accurate feedback information concerning the relevancy and effectiveness of his behavior;
- \*4. modifying teaching behavior where it is appropriate to improve team effectiveness;
5. trying out new patterns of thought and behavior in order to experience the process of change;
6. examining the nature of the team discussion to determine the emphasis which is placed on content and process;
7. examining and participating in the decision-making procedure of the team;
8. observing the behavior of the team from the point of view of what its purpose or function seems to be;
- \*9. demonstrating the ability to work as a team without alienating other members of the team or becoming alienated himself;
10. helping colleagues learn how to learn from the process of preparation-experimentation-feedback;
- \*11. directing a teacher aide in a task supporting the team effort without alienating the aide;

- \*12. modifying the direction given to a teacher aide on the basis of suggestions made by the aide;
- \*13. accepting directions or help from another member of an instructional team (lead teacher, science consultant, principal) without demonstrating personal disaffection;
- \*14. tolerating differences in values, language, and behavior patterns of other team members;
- \*15. demonstrating self-control by not showing frustration or anger in the face of probing questions or ideas which challenge his own position.

## V. CONCLUSION

There is, has been, and will be, much written on competency based teacher education. Its spirit and intent as a movement is being scrutinized, clarified, and exploited extensively in the literature. Just how much of these ideas and concepts are consistent with each other remains to be ascertained. What is highly probable is that many approaches will develop as to how and where teachers develop competence as well as in what competencies teachers should develop. The questions raised here were: (1) What teacher roles and models exist as organizers for certain subsumed competencies; (2) What enabling activities can be provided for selection and development of competence; (3) What learner competencies are the result of the teacher's competence; and (4) What degree of success can be anticipated when support elements in the teaching-learning environment are present or absent?

The consistent focus revolves around planning, implementation, and evaluation of materials and resources, teacher competencies, and, last but not least, learner competencies. It is not my contention to end at this point with the identification and categorization of competencies per se. The competencies listed are incomplete and are far from being all inclusive. Presently the notion of science competence is nebulous and idiosyncratic. It is particular and peculiar to certain regions reflecting a school of thought. The attempt here has been to specify competency statements that one selects from or is counseled through but ultimately results in consistent and just behavior with children. This responsibility is shared by

the individuals learning and the individuals teaching and extends itself to the shaping of the support system by which we exhibit that responsibility. It is not within our reach to create "perfect" institutions and people BUT, is well within reach to create justice, consistency and credibility in ourselves and our institutions.

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